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ABSTRACT

Forms for student self-checks and the instructor's final checklist (student evaluation) are provided for use with thirty-three learning modules on maintaining and servicing fuel and electrical systems in tractor mechanics. The student self-check asks the students questions about their understanding of the modules' content. The instructor's checklist consists of task descriptions and four possible teacher ratings of the students' performance. Rating choices are (1) not applicable, (2) not accomplished, (3) partially accomplished, and (4) fully accomplished. (CSS)

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ED171935

TRACTOR MECHANIC CHECK SHEETS FOR MODULES

CLEMSON UNIVERSITY
Vocational Education
Media Center
South Carolina

South Carolina State Dept. of Education,
Columbia
Office of Vocational Education

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
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CE 040 719

CE

NOTE TO THE INSTRUCTOR

The Student Self-Checks and the Instructor's Final Checklist are contained within the Learning Activity Packages. However, they are NOT TO BE WRITTEN ON by the student or the instructor because each copy will be utilized by several students. Therefore, you are being provided with a separate printing. You will use these as a master from which you can make as many copies as needed. Following are several methods for duplicating the self-checks and final checklist which may be available to you:

1. Electrostatic copies (Xerox)
2. Heat Process (Thermofax)
3. Thermofax Ditto Master. Use the printed master to make a thermofax ditto master. Copies may be duplicated using a fluid process duplicator.
4. School District Reproduction Shop.
5. Local Graphic Arts Department. (Confer with the graphic arts instructor for suggestions he may be able to give you regarding duplicating charts.)
6. Commercial Quick Print Shop (Photo Direct using offset press)

VE 020 719

STUDENT SELF--CHECK

CLEANING THE TRACTOR

1. Why must the tractor be cleaned before disassembly?

2. When should the burner be started on the steam cleaner?

3. Which tractor parts should not be cleaned?

Compare your answers with the correct responses on this page. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSES

1. To avoid contaminating internal parts

2. After water runs out the nozzle

3. The starter, alternator, generator, distributor and coil

LAP TM–1

Student _____

Date _____

CLEANING THE TRACTOR

Instructor's Final Checklist

Check the student's performance in the following elements of cleaning the tractor.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
1. To prepare the steam cleaner for use, the student:				
a. attached the water hose and power cord	[ ]	[ ]	[ ]	[ ]
b. turned on the fuel and started the pump	[ ]	[ ]	[ ]	[ ]
c. started the burner when water water ran from nozzle	[ ]	[ ]	[ ]	[ ]
2. The steam cleaner operated properly	[ ]	[ ]	[ ]	[ ]
3. In cleaning a tractor with the steam cleaner, the student:				
a. covered the exhaust and intake openings	[ ]	[ ]	[ ]	[ ]
b. applied degreaser to heavy grease and oil deposits	[ ]	[ ]	[ ]	[ ]
c. used protective clothing, gloves, and safety face shield	[ ]	[ ]	[ ]	[ ]
d. avoided steaming of areas such as starter, generator, alternator, distributor, and coil	[ ]	[ ]	[ ]	[ ]
e. continuously checked functioning of steam cleaner	[ ]	[ ]	[ ]	[ ]
4. The cleaned tractor showed no signs of dirt, oil, loose rust, or grease	[ ]	[ ]	[ ]	[ ]
5. In shutting down the steam cleaner, the student:				
a. shut off the burner	[ ]	[ ]	[ ]	[ ]
b. allowed the pump to run until water coming from the nozzle was cool	[ ]	[ ]	[ ]	[ ]

LAP TM–1

Student _____

Date _____

CLEANING THE TRACTOR

(Continued)
Instructor's Final Checklist

Check the student's performance in the following elements of cleaning the tractor.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
6. The steam cleaner was drained, cleaned, and stored in the proper shop location	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

RECEIVING NEW TRACTOR PARTS

1. When inspecting a new shipment of parts, you should check for two things. List them.

Compare your answers with the correct responses on this page. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSE

a. All parts ordered are received

b. Parts received are not damaged

LAP TM–2

Student _____

Date _____

RECEIVING NEW TRACTOR PARTS

Instructor's Final Checklist

Check the student's performance in the following elements of receiving new tractor parts.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
To inspect new parts for shipping damage, the student:				
1. opened package using tools that did not damage contents	[ ]	[ ]	[ ]	[ ]
2. removed and checked packing list with original invoice	[ ]	[ ]	[ ]	[ ]
3. noted any missing parts listed on the packing slip	[ ]	[ ]	[ ]	[ ]
4. removed each part and inspected for damage (breakage, dents, scratches, bends, etc.) that would prohibit its proper function	[ ]	[ ]	[ ]	[ ]
5. prepared damaged parts for return to supplier	[ ]	[ ]	[ ]	[ ]
6. put usable parts in appropriate storage until needed	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

ADJUSTING SPECIFIC GRAVITY READINGS

Suppose that you have three batteries to be tested for operating conditions. If .004 is added for each 10 F above 80 and .004 is subtracted for each 10 F below 80, calculate the true specific gravity reading for each cell as given. Show the amount you add or subtract to get the adjusted specific gravity. Use your specific-gravity chart for interpreting the adjusted specific gravity.

Compare your answers with the correct responses on the following page. Review any incorrect answers before going on to the next Learning Activity.

Battery No. 1 – 90°F [32.2 C]

Add or subtract

Cell No.	Specific Gravity Reading	Average Adjusted Specific Gravity
1	1.274	_____
2	1.271	_____
3	1.269	_____
4	1.267	_____
5	1.264	_____
6	1.262	_____

Probable condition of battery: (circle one)

Overcharged Undercharged
In Good Condition

Battery No. 2 – 120°F [49 C]

Add or subtract

Cell No.	Specific Gravity Reading	Average Adjusted Specific Gravity
1	1.163	_____
2	1.160	_____
3	1.158	_____

Probable condition of battery: (circle one)

Overcharged Undercharged
In Good Condition

Battery No. 3 – 70°F]21.1 C]

Add or subtract

Cell No.	Specific Gravity Reading	Average Adjusted Specific Gravity
1	1.175	_____
2	1.173	_____
3	1.170	_____
4	1.006	_____
5	1.150	_____
6	1.283	_____

Probable condition of battery: (circle one)

Overcharged Undercharged
In Good Condition

CORRECT RESPONSES

1. Add .004; Cell 1 – 1.278; Cell 2 – 1.275; Cell 3 – 1.273; Cell 4 – 1.271; Cell 5 – 1.268; Cell 6 – 1.266; Average – 1.2718; Battery is in good condition.

2. Add .916; Cell 1 – 1.179; Cell 2 – 1.176; Cell 3 – 1.174; Average – 1.143; Battery is undercharged.

3. Subtract .004; Cell 1 – 1.171; Cell 2 – 1.169; Cell 3 – 1.166; Cell 4 – 1.002; Cell 5 – 1.146; Cell 6 – 1.279; Average – 1.155; Battery condition is undercharged. (In this case, since ther is more than 50 gravity points difference between the highest [Cell 6] and the lowest [Cell 4], the battery should be replaced.)

LAP TM–3

Student _____

Date _____

TESTING A BATTERY

Instructor's Final Checklist

Check the student's performance in the following elements of testing a battery.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
1. In using a hydrometer to measure the specific gravity of a battery, the student:				
a. shook hydrometer gently to keep the float from sticking to the sides	[ ]	[ ]	[ ]	[ ]
b. held the hydrometer and float at eye level and read the scale	[ ]	[ ]	[ ]	[ ]
c. took temperature reading of the electrolyte and made the hydrometer reading adjustment	[ ]	[ ]	[ ]	[ ]
d. interpreted the readings using a specific-gravity chart	[ ]	[ ]	[ ]	[ ]
2. The interpreted readings for all cells were the same as the instructor's	[ ]	[ ]	[ ]	[ ]
3. In measuring the voltage of a battery with a voltmeter, the student:				
a. turned on the starter switch just long enough to get a voltmeter reading	[ ]	[ ]	[ ]	[ ]
b. secured a voltage reading	[ ]	[ ]	[ ]	[ ]
c. made the same interpretation as the instructor's	[ ]	[ ]	[ ]	[ ]

LAP TM–3

Student _____

Date _____

TESTING A BATTERY
(Continued)
Instructor's Final Checklist

Check the student's performance in the following elementr of testing a battery.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
4. Using a load-testing machine to load-test a battery, the student:				
a. checked the specific gravity of the battery	[ ]	[ ]	[ ]	[ ]
b. secured the same results as the instructor	[ ]	[ ]	[ ]	[ ]
5. In load-testing a battery using the starting motor, the student:				
a. made sure the ignition was off	[ ]	[ ]	[ ]	[ ]
b. connected the voltmeter to the battery correctly	[ ]	[ ]	[ ]	[ ]
c. engaged the starter for at least 30 seconds	[ ]	[ ]	[ ]	[ ]
d. secured the same voltage reading as the instructor	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

SERVICING BATTERY CONNECTIONS

Answer the following:

1. To avoid damage to the battery, you should always use a _____ to remove the battery cable from the battery.

2. What solution should be used to clean a battery?

3. Why avoid getting solution into the battery?

4. Apply a coating of _____ or _____ to the battery posts and cable clamps to protect against further corrosion.

5. What causes corrosion of the battery terminals?

6. Can a battery lose its charge as a result of accululated dust and dirt on the surface of the battery? (Check One) Yes ____ No ____ Why?

7. Why is it important to remove the ground cable first and install it last?

Compare your answers with the correct responses at the bottom of this page. Review any incorrect answers before going on to the next learning activity.

CORRECT RESPONSES

1. Battery clamp puller
2. Two tablespoons of baking soda to a pint of water
3. Contaminates electrolyte, which will cause the battery to remain discharged
4. Grease, petroleum jelly
5. Acid and moisture
6. Yes; retains moisture which causes short between terminals.
7. This decreases the chance of creating a short circuit with the wrench.

LAP TM–4

Student _____

Date _____

SERVICING BATTERY CONNECTIONS

Instructor's Final Checklist

Check the student's performance in the following elements of servicing battery connections.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

		Student Performance			
		Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
1.	In cleaning the battery terminals, cables and battery box, the student:				
	a. disconnected the ground cable first	[ ]	[ ]	[ ]	[ ]
	b. removed the battery from the tractor	[ ]	[ ]	[ ]	[ ]
	c. cleaned the designated battery terminals, cables, and box so that there was no visible dirt, moisture, or acid	[ ]	[ ]	[ ]	[ ]
	d. reconnected the battery correctly, ground cable last	[ ]	[ ]	[ ]	[ ]
2.	The student tightened the battery cables and hold-down clamps so that when pressure was applied, no movements of the battery or cables occurred	[ ]	[ ]	[ ]	[ ]
3.	In treating the battery terminals, the student:				
	a. coated all areas subject to corrosion with a light grease	[ ]	[ ]	[ ]	[ ]
	b. avoided coating areas between post and clamp where electrical contact was made	[ ]	[ ]	[ ]	[ ]
	c. wiped off excess grease	[ ]	[ ]	[ ]	[ ]
	d. disposed of greasy rags safely	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

ACTIVATING A BATTERY

1. A dry-charged battery is charged:

   (a) in the field
   (b) at the factory

2. A dry-charged battery is activated:

   (a) in the field or warehouse
   (b) at the factory

3. One disadvantage of using a dry-charged battery is:

   (a) will not hold a charge when properly stored for more than a couple of weeks
   (b) acids must be handled and it is difficult to check the quality of the battery before shipment from the factory.

4. After the battery has been in service and the electrolyte level gets low, acid should be added until the electrolyte level reaches the proper level. (True or False)

Compare your answers with the correct responses on the following page. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSES

1. b
2. a
3. b
4. False – Acid should NEVER be added after a battery has been in service.

LAP TM–5

Student _____

Date _____

ACTIVATING A BATTERY

Instructor's Final Checklist

Check the student's performance in the following elements of activating a battery.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
To activate a dry-charged battery, the student:				
1. removed caps from the battery cells	[ ]	[ ]	[ ]	[ ]
2. filled the battery cells with electrolyte using a battery syringe	[ ]	[ ]	[ ]	[ ]
3. slow-charged the battery overnight in a well-ventilated area	[ ]	[ ]	[ ]	[ ]
4. cleaned and replaced the battery caps making sure vent holes were clear	[ ]	[ ]	[ ]	[ ]
5. measured the battery voltage with a voltmeter	[ ]	[ ]	[ ]	[ ]
6. had a reading on the voltmeter that was within one volt of the instructor's reading	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

CHARGING A BATTERY

Answer the following:

1. Batteries are charged by _____ their flow of current using an outside power source.

2. There are two ways to recharge a battery: _____ and _____ .

3. If a battery is sulfated, use a _____ but reduce the charging rate.

4. If the battery is badly sulfated and will not accept a fast charge, use the _____ _____ method.

5. If fast charging is used, never exceed _____ amps for a 12-volt battery or _____ amps for a 6-volt battery.

6. Do not heat up the battery electrolyte above _____ ^{o}F.

7. To assure a fully charged battery, follow the _____ _____ with a _____ _____ .

8. After charging, always check the _____ _____ in each cell.

Compare your answers with the correct responses on this page. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSES

1. Reversing
2. Fast charging, slow charging
3. Fast charge
4. Slow charging
5. 40, 70
6. 120 (49 C)
7. Fast charge, slow charge
8. Electrolyte level

LAP TM–6

Student _____

Date _____

CHARGING A BATTERY

Instructor's Final Checklist

Check the student's performance in the following elements of charging a battery.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

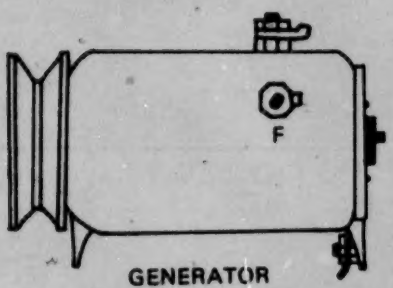
Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

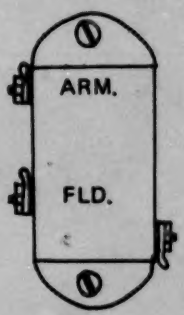
		Student Performance			
		Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
1.	In charging a battery, the student:				
	a. removed caps and added distilled water	[ ]	[ ]	[ ]	[ ]
	b. checked specific gravity	[ ]	[ ]	[ ]	[ ]
	c. charged battery at moderate rate for 4–6 hours	[ ]	[ ]	[ ]	[ ]
	d. checked battery periodically to determine degrees of charge	[ ]	[ ]	[ ]	[ ]
	e. turned off and removed charger when battery reached full charge	[ ]	[ ]	[ ]	[ ]
	f. used caution in handling the battery and electrolyte	[ ]	[ ]	[ ]	[ ]
	g. cleaned electrolyte off the top of the battery	[ ]	[ ]	[ ]	[ ]
2.	The student's specific gravity reading was the same as the instructor's	[ ]	[ ]	[ ]	[ ]
3.	The electrolyte level was 3/8" above the plates	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

UNDERSTANDING THE CHARGING CIRCUIT

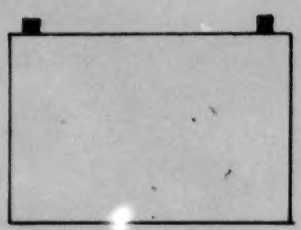
1. When the engine is running, the _____ supplies the electrical energy needed to operate the machine.
2. When starting the engine, the _____ supplies the electrical energy needed.
3. The faster the generator is turned by the engine, the higher the voltage produced. (True, False)
4. The purpose of a field pole is to strengthen the magnetic field, (True, False)
5. The brushes carry current (to, from) the generator.
6. A third brush-type generator is used where a high current output is not required. (True, False)
7. The _____ of a generator determines the direction of current flow between the generator and the external circuit.
8. The generator is prevented from producing excess voltage by _____.
9. The generator produces _____ current, while the alternator produces _____ current.
10. The diode is in the circuit to _____.
11. Draw in the wiring on the diagram below.





REGULATOR

BAT.

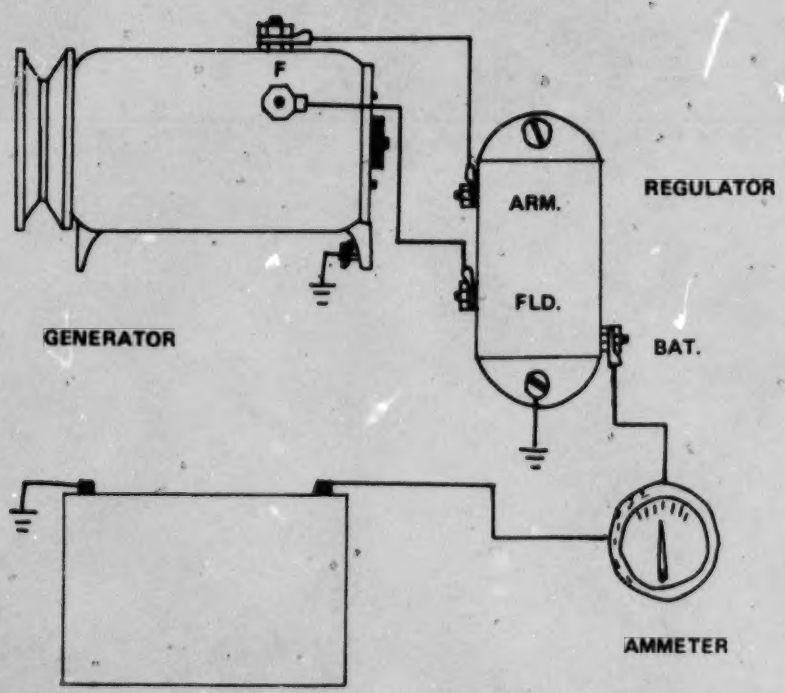


AMMETER

Compare your answers with the correct responses on the following page. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSES

1. generator
2. battery
3. true
4. true
5. from
6. true
7. polarization
8. voltage regulator
9. D.C., A.C.
10. Change A.C. current to D.C. current.
11. See the illustration below:



LAP TM-7

Student _____

Date _____

TESTING THE CHARGING CIRCUIT

Instructor's Final Checklist

Check the student's performance in the following elements of testing the charging circuit.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
1. In testing the charging circuit, the student:				
a. set up test equipment correctly	[ ]	[ ]	[ ]	[ ]
b. tested the circuit at a 10 amp load	[ ]	[ ]	[ ]	[ ]
c. adjusted voltmeter reading for temperature with the engine at operating temperature	[ ]	[ ]	[ ]	[ ]
d. got the same readings as the instructor	[ ]	[ ]	[ ]	[ ]
2. In testing the generator, the student:				
a. set up test equipment correctly	[ ]	[ ]	[ ]	[ ]
b. tested generator at recommended speed	[ ]	[ ]	[ ]	[ ]
c. got the same reading as the instructor	[ ]	[ ]	[ ]	[ ]
3. In testing the armature and field, the student:				
a. checked visually for an open circuit	[ ]	[ ]	[ ]	[ ]
b. checked for an open circuit using the growler and combination unit	[ ]	[ ]	[ ]	[ ]
c. tested for shorted and grounded armature	[ ]	[ ]	[ ]	[ ]
d. tested field circuit	[ ]	[ ]	[ ]	[ ]
e. recorded readings which matched those taken by the instructor	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

UNDERSTANDING REGULATORS

1. The voltage regulator is the control mechanism for the generator or alternator. (T or F)

2. The main purpose of the cut-out relay is to open and close the circuit between the generator and the battery. (T or F)

3. The main purpose of the voltage regulator is to control the voltage output of the generator. (T or F)

4. The main purpose of the current regulator is to control the current output or amperage of the generator. (T or F)

5. Resistors reduce a sudden surge of voltage in the field coils. (T or F)

6. How many resistors are used in the regulator circuit?

7. The cut-out relay is connected to the generator and _____.

8. The current regulator is connected to the generator and _____.

9. The voltage regulator component is connected to the regulator and _____.

10. Match the following:

a.	The "BAT" terminal on the regulator	1.	The generator field winding
b.	The "GEN" terminal on the regulator	2.	The generator armature winding
c.	The "FIELD" terminal on the regulator	3.	The Battery

Compare your answers with the correct responses. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSES

1. True
2. True
3. True
4. True
5. True
6. two
7. battery
8. cut-out relay
9. ground
10. a. 3
    b. 2
    c. 1

LAP TM–8

Student _____

Date _____

ADJUSTING THE VOLTAGE REGULATOR

Instructor's Final Checklist

Check the student's performance in the following elements of adjusting the voltage regulator.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
In adjusting the voltage regulator, the student:				
1. checked the manufacturer's service manual for specifications	[ ]	[ ]	[ ]	[ ]
2. checked the voltage readings using a voltmeter	[ ]	[ ]	[ ]	[ ]
3. adjusted the voltage to the value specified in the manufacturer's service manual	[ ]	[ ]	[ ]	[ ]
4. checked the current reading using an ammeter	[ ]	[ ]	[ ]	[ ]
5. adjusted the amperage to the value specified in the manufacturer's service manual	[ ]	[ ]	[ ]	[ ]
6. cleaned all parts of the regulator system	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

SERVICING THE ALTERNATOR

1. Never operate the alternator on an open circuit. All three circuit components must be connected. (T or F)

2. Never attempt to polarize an alternator. (T or F)

3. The two main alternator types are the _____ and the _____ alternator.

4. An alternator is a D.C. generator. (T or F)

5. Alternator = moving rotor + fixed stator + diode rectifier. (T or F)

6. An alternator works on the same principle as a generator. (T or F)

Compare your answers with the correct responses at the bottom of this page. Review any incorrect answers before you go on to the next learning activity

CORRECT RESPONSES

1. True
2. True
3. Closed-type, Open-type
4. False
5. True
6. False

LAP TM–9

Student _____

Date _____

SERVICING THE ALTERNATOR

Instructor's Final Checklist

Check the student's performance in the following elements of servicing the alternator.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
In servicing the alternator, the student:				
1. checked the manufacturer's service manual for instructions on testing the alternator regulator	[ ]	[ ]	[ ]	[ ]
2. made adjustments as recommended in the manufacturer's service manual	[ ]	[ ]	[ ]	[ ]
3. checked both high and low sides of the diode	[ ]	[ ]	[ ]	[ ]
4. replaced the defective diode	[ ]	[ ]	[ ]	[ ]
5. located, removed and replaced the heat sink	[ ]	[ ]	[ ]	[ ]
6. checked each unit for proper operation and made any needed adjustments	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

SERVICING THE GENERATOR

1. Generator brushes should be replaced when:

   a. they show any signs of wear
   b. if worn to less than half their original length
   c. anytime the tractor battery does not have sufficient charge to start the tractor
   d. anytime the generator does not produce current

2. Polarizing the generator is necessary in order that:

   a. the generator will operate
   b. the current flows in the desired direction

3. An externally grounded generator is polarized by:

   a. touching a short jumper wire to the "BAT" and "GEN" (or "ARM") posts of the regulator momentarily
   b. touching the ends of "BAT" and "FLD" wires together momentarily

CORRECT RESPONSES

1.b, 2.b, 3.a

LAP TM–10

Student _____

Date _____

SERVICING THE GENERATOR
Instructor's Final Checklist

Check the student's performance in the following elements of servicing the generator.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
In servicing the generator, the student:				
1. checked the manufacturer's service manual for specifications	[ ]	[ ]	[ ]	[ ]
2. removed the generator from the engine	[ ]	[ ]	[ ]	[ ]
3. cleaned the generator housing	[ ]	[ ]	[ ]	[ ]
4. removed and properly replaced the generator brushes	[ ]	[ ]	[ ]	[ ]
5. inspected the bearings and replaced if defective	[ ]	[ ]	[ ]	[ ]
6. turned the armature until it was smooth and round	[ ]	[ ]	[ ]	[ ]
7. checked the armature with a micrometer	[ ]	[ ]	[ ]	[ ]
8. reassembled the generator and checked for smoothness of operation	[ ]	[ ]	[ ]	[ ]
9. replaced the generator on the tractor engine	[ ]	[ ]	[ ]	[ ]
10. polarized the system	[ ]	[ ]	[ ]	[ ]
11. tested the charging circuit	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

REPLACING AN AMPERAGE GAUGE

1. An amperage reading to the left of zero, or in the negative amps region on the meter indicates the battery is charging. (True or False)

2. An amperage meter should be repaired instead of replaced. (True or False)

Compare your answers with the correct responses on this page. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSES

1. False

2. False

LAP TM-11

Student _____

Date _____

REPLACING AN AMPERAGE GAUGE

Instructor's Final Checklist

Check the student's performance in the following elements of replacing an amperage gauge.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
In replacing an amperage gauge, the student:				
1. secured replacement gauge	[ ]	[ ]	[ ]	[ ]
2. checked the manufacturer's service manual for instructions on how to remove and replace the gauge	[ ]	[ ]	[ ]	[ ]
3. identified wires connected to the old gauge	[ ]	[ ]	[ ]	[ ]
4. removed the old gauge and installed a new one	[ ]	[ ]	[ ]	[ ]
5. checked the gauge, with all systems working, for proper operation	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

USING ELECTRICAL TEST EQUIPMENT

1. The three basic electrical test instruments are:
   a.
   b.
   c.

2. _____ are connected into the electrical circuit.

3. _____ are connected in parallel with the circuit.

4. _____ are used to check wiring for resistance, and to check for open or broken wire.

5. When two electrical wires are touching they are said to be _____ .

6. An electrical wire touching bare metal would be _____ .

Compare your answers with the correct responses at the bottom of this page. Review any incorrect answers before you go on to the next learning activity.

CORRECT RESPONSES

1. a. voltmeter
   b. ohmmeter
   c. ammeter
2. ammeters
3. voltmeters
4. ohmmeters
5. shorted
6. grounded

LAP TM–12

Student _____

Date _____

SERVICING THE IGNITION WIRES

Instructor's Final Checklist

Check the student's performance in the following elements of servicing the ignition wires.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
In servicing the ignition wires the student:				
1. checked manufacturer's service manual for wire specifications	[ ]	[ ]	[ ]	[ ]
2. used ohmmeter to check wire for resistance	[ ]	[ ]	[ ]	[ ]
3. cut new wire to proper length	[ ]	[ ]	[ ]	[ ]
4. used crimpers when replacing terminals	[ ]	[ ]	[ ]	[ ]
5. determined rotation and firing order	[ ]	[ ]	[ ]	[ ]
6. removed and numbered spark plug wires	[ ]	[ ]	[ ]	[ ]
7. reinstalled all wiring, using proper sequence	[ ]	[ ]	[ ]	[ ]
8. checked for proper operation	[ ]	[ ]	[ ]	[ ]
9. drew from memory a rough sketch of the ignition system used on most farm tractors	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

SERVICING SPARK PLUGS

Answer the following questions True or False.

1. The spark plug ignites the fuel-air mixture in the combustion chamber.

2. Spark plugs never wear out and never have to be replaced.

3. To gap a spark plug, bend the center electrode until the spark gap gauge fits snugly.

4. Badly fouled plugs should be replaced.

5. The first sign of failing plugs is engine misfire.

Compare your answers with the correct responses on this page. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSES

1. True
2. False
3. False – never bend center electrode
4. True
5. True

LAP TM–13

Student _____

Date _____

SERVICING SPARK PLUGS

Instructor's Final Checklist

Check the student's performance in the following elements of servicing spark plugs.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
In servicing spark plugs, the student:				
1. checked manufacturer's service manual for proper gap setting	[ ]	[ ]	[ ]	[ ]
2. removed spark plug wire	[ ]	[ ]	[ ]	[ ]
3. loosened plug and blew debris away with air hose	[ ]	[ ]	[ ]	[ ]
4. inspected plug for broken or damaged parts and for condition of electrode; replaced if defective	[ ]	[ ]	[ ]	[ ]
5. cleaned plug	[ ]	[ ]	[ ]	[ ]
6. adjusted spark plug gap	[ ]	[ ]	[ ]	[ ]
7. reinstalled plug; started plug by hand and torqued to manufacturer's specifications	[ ]	[ ]	[ ]	[ ]
8. reinstalled spark plug wire	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

SERVICING THE COIL

Answer the following True or False:

1. **The coil cannot be repaired.**

2. **The coil is the high voltage source of the spark necessary for combustion.**

3. **Polarity does not affect the performance of the coil.**

4. **A coil is a transformer which increases voltage.**

Compare your answers with the correct responses on this page. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSES

1. True
2. True
3. False
4. True

LAP TM–14

Student _____

Date _____

SERVICING THE COIL

Instructor's Final Checklist

Check the student's performance in the following elements of servicing the coil.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
In servicing the coil, the student:				
1. removed wires from coil	[ ]	[ ]	[ ]	[ ]
2. connected suitable coil tester to input and output terminals	[ ]	[ ]	[ ]	[ ]
3. checked coil for proper voltage as listed in the manufacturer's service manual	[ ]	[ ]	[ ]	[ ]
4. obtained the proper coil for the tractor and replaced coil if it was defective	[ ]	[ ]	[ ]	[ ]
5. rechecked coil to get proper reading	[ ]	[ ]	[ ]	[ ]
6. reinstalled all ignition wiring and checked for proper operation	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

SERVICING THE DISTRIBUTOR

1. The distributor does three things. What are they?

2. A point gap set too wide produces a _____ spark.

3. Which of the following can be caused by improper timing?

   a. knocking; b. backfiring;
   c. warped valves; d. loss of power;
   e. damage to engine parts.

4. List two methods that can be used to time an engine. Which is the best?

Compare your answers with the correct responses on the following page. Review any incorrect answers before going on to the next Learning Activity

CORRECT RESPONSES

1. a. Opens and closes the primary circuit;
   b. Times the high voltage surges;
   c. Directs current to the proper spark plug.

2. Weak

3. All of them

4. Breaker-point method, timing light method – the timing light method is the best.

LAP TM–15

Student _____

Date _____

SERVICING THE DISTRIBUTOR

Instructor's Final Checklist

Check the student's performance in the following elements of servicing the distributor.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

		Student Performance			
		Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
1.	In servicing an ignition distributor, the student:				
a.	removed dirt from the outside surface of distributor and cap	[ ]	[ ]	[ ]	[ ]
b.	cleaned inner surface	[ ]	[ ]	[ ]	[ ]
c.	identified defective cap (chips, breaks, cracks) and replaced	[ ]	[ ]	[ ]	[ ]
d.	cleaned the rotor arm	[ ]	[ ]	[ ]	[ ]
e.	checked the dust cover	[ ]	[ ]	[ ]	[ ]
2.	In replacing the ignition distributor, the student:				
a.	removed the primary and secondary ignition wires from the distributor	[ ]	[ ]	[ ]	[ ]
b.	noted the position of the rotor	[ ]	[ ]	[ ]	[ ]
c.	loosened bolts and removed old distributor	[ ]	[ ]	[ ]	[ ]
d.	installed a new distributor	[ ]	[ ]	[ ]	[ ]
e.	reconnected primary and secondary ignition wires	[ ]	[ ]	[ ]	[ ]
f.	set breaker points to specifications	[ ]	[ ]	[ ]	[ ]
g.	set ignition timing to specifications	[ ]	[ ]	[ ]	[ ]
h.	adjusted the distributor advance mechanism to within three degrees of specifications	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

TESTING THE CRANKING CIRCUIT

1. In the cranking circuit the_____ supplies energy to the starter.

2. The solenoid switch is on the outside of the starter-motor housing. (T or F)

3. Starter motor brushes should be replaced when they are worn to _____ the original length.

4. _____should be used in cleaning a commutator.

5. The starting motor should never be run for more than_____ without resting it for a few minutes.

6. When replacing starter brushes, always use a matched set of brushes. (T or F)

7. The three tests used for armature testing are a._____ b._____ and c. _____.

Compare your answers with the correct responses on the following page. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSES

1. Battery
2. True
3. 1/2
4. 00 Sandpaper
5. 30 Seconds
6. True
7. a. ground test
   b. short test
   c. balance test

LAP TM–16

Student _____

Date _____

TESTING THE STARTING CIRCUIT

Instructor's Final Checklist

Check the student's performance in the following elements of testing the starting circuit.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
In testing the starting circuit, the student:				
1. disconnected all wires from the ignition switch and noted their position	[ ]	[ ]	[ ]	[ ]
2. checked the switch for shorts, using the continuity tester	[ ]	[ ]	[ ]	[ ]
3. checked the switch for contact, using the continuity tester	[ ]	[ ]	[ ]	[ ]
4. reinstalled the switch and checked for proper operation	[ ]	[ ]	[ ]	[ ]
5. checked the safety switch, using the same procedure as used with the ignition switch	[ ]	[ ]	[ ]	[ ]
6. checked the solenoid using the outline on Instruction Sheet I	[ ]	[ ]	[ ]	[ ]
7. removed the starter	[ ]	[ ]	[ ]	[ ]
8. completed the ground test	[ ]	[ ]	[ ]	[ ]
9. completed a short test	[ ]	[ ]	[ ]	[ ]
10. completed a balance test	[ ]	[ ]	[ ]	[ ]
11. tested the field	[ ]	[ ]	[ ]	[ ]
12. reinstalled the starter	[ ]	[ ]	[ ]	[ ]
13. checked for proper operation	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

SERVICING A STARTER

1. Briefly explain the function of a starter motor.

2. Explain why a starter should not be "cranked" longer than thirty seconds.

3. Starting motor brushes worn to (a) 1/3; (b) 1/4; (c) 1/2; (d) 3/4 their length should be replaced.

4. Which of the following should never be used when cleaning a starting motor commutator? (a) emery cloth; (b) smooth mill file; (c) 00 sandpaper.

Compare your answers with the correct responses on this page. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSES

1. The starting motor serves to turn the flywheel to start the engine.

2. A starter "cranked" longer than 30 seconds will become overheated and damaged.

3. (c) 1/2

4. (a) (b)

LAP TM–17

Student _____

Date _____

SERVICING THE STARTER

Instructor's Final Checklist

Check the student's performance in the following elements of servicing the starter.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
In servicing the starter, the student:				
1. removed the starter	[ ]	[ ]	[ ]	[ ]
2. dismantled the starter	[ ]	[ ]	[ ]	[ ]
3. removed the starter drive	[ ]	[ ]	[ ]	[ ]
4. installed a new drive	[ ]	[ ]	[ ]	[ ]
5. installed new bushings	[ ]	[ ]	[ ]	[ ]
6. correctly reassembled the starter	[ ]	[ ]	[ ]	[ ]
7. bench tested the starter	[ ]	[ ]	[ ]	[ ]
8. installed and tested the starter on the tractor	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

REPLACING THE STARTER MOTOR

1. Briefly explain why the ground cable must be disconnected before any work on the starter is attempted.

2. Arrange the steps listed in the correct order for replacing the starter.

   A Replace battery ground cable.

   B Replace starter cable.

   C Bolt on replacement starter.

   D Disconnect cable from starter.

   E Disconnect battery ground cable.

   F Check for correct operation.

   G Thoroughly clean mount area for good grounding.

   H Compare old starter with replacement starter to be sure of correct fit.

   I Unbolt starter from engine.

CORRECT RESPONSES

1. The ground strap must be disconnected in order to prevent accidental starting of the engine and to prevent burns from accidental short circuits.

2. 1. E
   2. D
   3. I
   4. H
   5. G
   6. C
   7. B
   8. A
   9. F

LAP TM–18

Student _____

Date _____

REPLACING THE STARTER MOTOR

Instructor's Final Checklist

Check the student's performance in the following elements of replacing the starter motor.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
When replacing the starter motor, the student:				
1. disconnected starter	[ ]	[ ]	[ ]	[ ]
2. removed starter from engine	[ ]	[ ]	[ ]	[ ]
3. installed new starter	[ ]	[ ]	[ ]	[ ]
4. replaced cable and ground	[ ]	[ ]	[ ]	[ ]
5. checked correct operation	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

REPLACING THE RING GEAR ON A FLYWHEEL

1. The ring gear meshes with the _____ to ensure starting.

   a. generator
   b. alternator
   c. starter
   d. distributor

2. A damaged ring gear can result in _____.

   a. starter slippage
   b. failure to start
   c. starter locking down
   d. all of the above

3. The reason for heating ring gear before trying to place it on the flywheel is:

   a. It makes ring gear harder.
   b. It cleans grease off of gear.
   c. It causes it to expand.
   d. None of the above.

Compare your answers with the correct responses on this page. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSES

1. c
2. d
3. c

LAP TM–19

Student _____

Date _____

REPLACING THE RING GEAR ON A FLYWHEEL

Instructor's Final Checklist

Check the student's performance in the following elements of replacing the ring gear on a flywheel.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

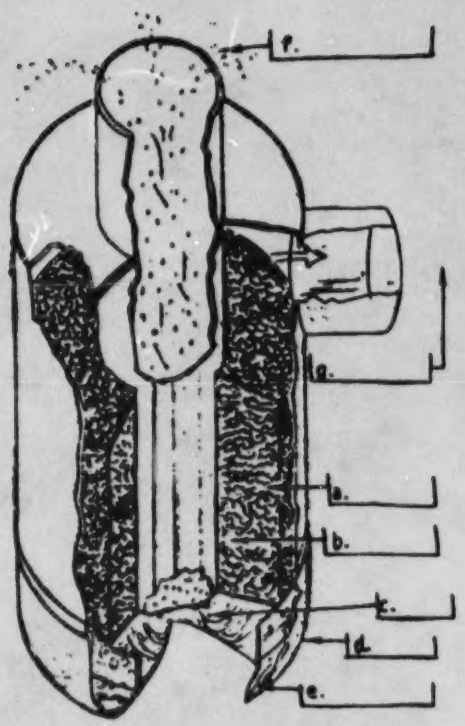
Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
In replacing the ring gear, the student:				
1. removed flywheel	[ ]	[ ]	[ ]	[ ]
2. removed old ring gear without damaging the flywheel	[ ]	[ ]	[ ]	[ ]
3. reinstalled ring gear on flywheel	[ ]	[ ]	[ ]	[ ]
4. reinstalled flywheel so that starter engaged correctly	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

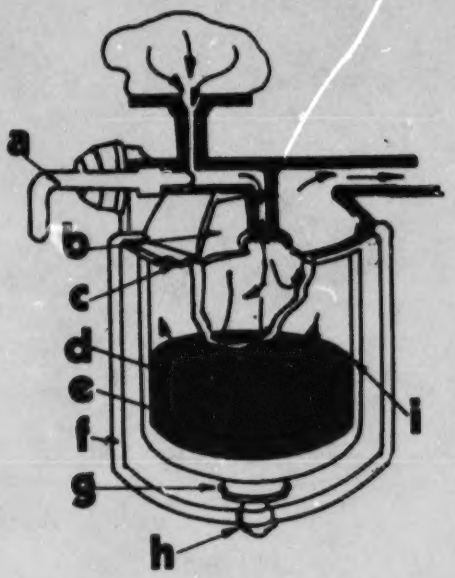
IDENTIFYING PARTS OF FUEL AND AIR FILTERS

1. **Label the following drawing of an oil-bath air filter:**



Courtesy of the American Association for Vocational Instructional Materials

2. **Identify and label the following parts of the gasoline fuel filter (sediment bowl):**



Compare your answers with the correct responses in the answer box. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSES

1. (a) filtering element (b) oil spray
(c) oil (d) oil cup (e) trapped dirt
(f) dirt particles (g) clean air

2. (a) shut-off valve (b) filter screen
(c) gasket (d) water (e) dirt (f) bail
(g) nut (h) bail-screw (i) filter bowl

LAP TM-20

Student _____

Date _____

SERVICING FUEL AND AIR FILTERS

Instructor's Final Checklist

Check the student's performance in the following elements of servicing fuel and air filters.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

		Student Performance			
		Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
1.	In servicing air filters, the student:				
	a. loosened and removed the oil cup from filter	[ ]	[ ]	[ ]	[ ]
	b. checked depth of sediment deposit in outer chamber	[ ]	[ ]	[ ]	[ ]
	c. cleaned oil cup	[ ]	[ ]	[ ]	[ ]
	d. checked and cleaned air intake pipe	[ ]	[ ]	[ ]	[ ]
	e. refilled oil cup to oil fill mark	[ ]	[ ]	[ ]	[ ]
	f. used correct oil	[ ]	[ ]	[ ]	[ ]
	g. replaced oil cup and tightened clamp	[ ]	[ ]	[ ]	[ ]
	h. checked air duct between cleaner and carburetor for holes or loose connections; tightened or replaced as needed	[ ]	[ ]	[ ]	[ ]
	i. removed debris from inlet screen or precleaner	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

UNDERSTANDING THE FUEL SYSTEM

Draw a diagram of the fuel flow pattern for the designated tractor.

CORRECT RESPONSES

Check this with the manufacturer's service manual.

LAP TM–21

Student _____

Date _____

SERVICING FUEL TANKS AND LINES

Instructor's Final Checklist

Check the student's performance in the following elements of servicing fuel tanks and lines.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

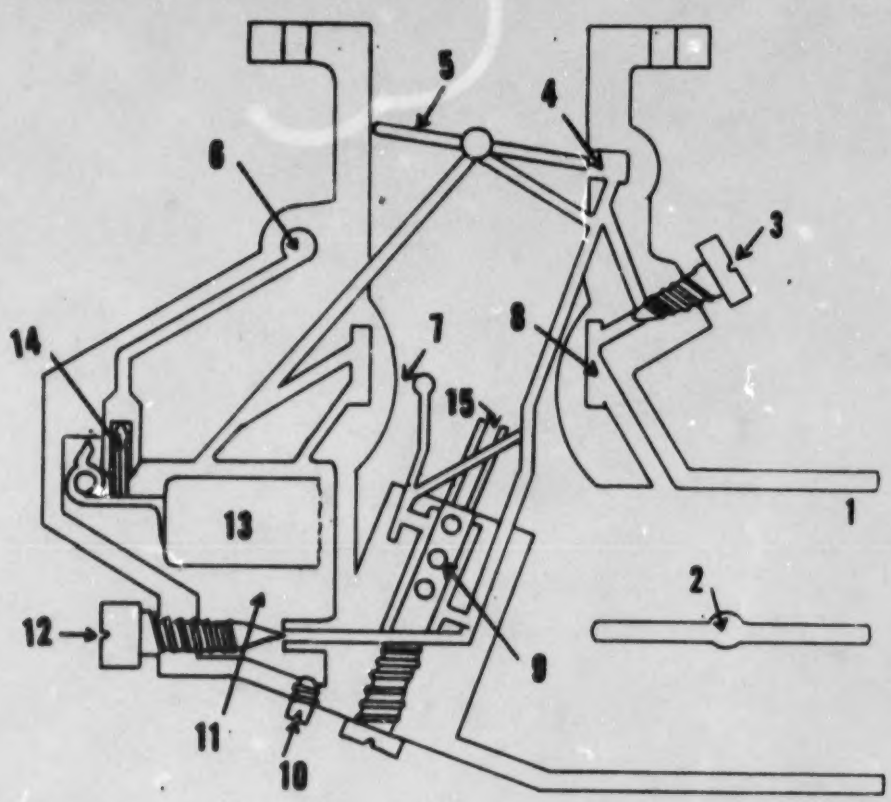
Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

		Student Performance			
		Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
1.	In servicing the fuel tanks and fuel lines, the student:				
	a. visually inspected the system for problems	[ ]	[ ]	[ ]	[ ]
	b. drained fuel from the tank	[ ]	[ ]	[ ]	[ ]
	c. thoroughly cleaned the fuel tank	[ ]	[ ]	[ ]	[ ]
	d. removed, cleaned, and reinstalled fuel shut-off valve	[ ]	[ ]	[ ]	[ ]
	e. cleaned sediment bowl and screen	[ ]	[ ]	[ ]	[ ]
	f. flushed fuel lines	[ ]	[ ]	[ ]	[ ]
	g. cleaned carburetor fuel screen	[ ]	[ ]	[ ]	[ ]
	h. checked for leaks	[ ]	[ ]	[ ]	[ ]
2.	The fuel tanks, fuel lines, and sediment bowl did not leak	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

LABELING CARBURETOR PARTS

Label the parts of the following diagram:



Compare your answers with the correct responses at the bottom of this page. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSES

1. air horn (intake)
2. choke
3. idle adjusting needle
4. idle orifice
5. throttle
6. fuel intake
7. venturi
8. idle circuit
9. accelerator adjusting well
10. bowl drain plug
11. float bowl
12. full load adjusting needle
13. float
14. needle valve
15. main jet

LAP TM-22

Student _____

Date _____

ADJUSTING A CARBURETOR

Instructor's Final Checklist

Check the student's performance in the following elements of adjusting a carburetor.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

		Student Performance			
		Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
1.	In adjusting the idle mixture, the student:				
	a. checked and cleaned the air intake	[ ]	[ ]	[ ]	[ ]
	b. brought engine to operating temperature	[ ]	[ ]	[ ]	[ ]
	c. checked the set idle speed	[ ]	[ ]	[ ]	[ ]
	d. adjusted idle mixture (lean to rich to balanced)	[ ]	[ ]	[ ]	[ ]
	e. advanced throttle and returned to idle	[ ]	[ ]	[ ]	[ ]
	f. checked speed with tachometer	[ ]	[ ]	[ ]	[ ]
2.	In adjusting the idle speed, the student:				
	a. checked and cleaned the air intake	[ ]	[ ]	[ ]	[ ]
	b. brought engine to operating temperature	[ ]	[ ]	[ ]	[ ]
	c. turned idle speed screw to obtain correct idle speed	[ ]	[ ]	[ ]	[ ]
	d. rechecked speed with tachometer	[ ]	[ ]	[ ]	[ ]
3.	The engine idled at manufacturer's recommended speed	[ ]	[ ]	[ ]	[ ]
4.	The engine idled smoothly with no excess smoking	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

UNDERSTANDING CARBURETORS

Answer the following:

1. **What purpose does a carburetor serve?**

2. **What does the float do?**

3. **What should you do if there is fuel inside the float?**

4. **List six things that affect carburetion:**
   a.
   b.
   c.
   d.
   e.
   f.

Compare your answers with the correct responses in the answer box. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSES

1. It mixes air and fuel in correct proportions and delivers the right amount of mixture to the engine.

2. Control fuel level in the carburetor

3. Replace it

4. a) fuel supply
   b) air cleaner
   c) carburetor
   d) governor
   e) compression
   f) ignition

LAP TM 23

Student _____

Date _____

SERVICING A CARBURETOR

Instructor's Final Checklist

Check the student's performance in the following elements of servicing a carburetor.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

		Student Performance			
		Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
1.	When cleaning the carburetor, the student:				
	a. turned off the fuel	[ ]	[ ]	[ ]	[ ]
	b. removed the carburetor	[ ]	[ ]	[ ]	[ ]
	c. removed the top of the carburetor	[ ]	[ ]	[ ]	[ ]
	d. cleaned all the dirt from:				
	1. carburetor top	[ ]	[ ]	[ ]	[ ]
	2. float	[ ]	[ ]	[ ]	[ ]
	3. needle valve and seat	[ ]	[ ]	[ ]	[ ]
	e. cleaned both halves of the carburetor body	[ ]	[ ]	[ ]	[ ]
	f. reassembled the carburetor	[ ]	[ ]	[ ]	[ ]
	g. installed and adjusted the carburetor	[ ]	[ ]	[ ]	[ ]
2.	When adjusting the float, the student:				
	a. removed and inspected the float	[ ]	[ ]	[ ]	[ ]
	b. reinstalled or replaced the float	[ ]	[ ]	[ ]	[ ]
	c. checked float height	[ ]	[ ]	[ ]	[ ]
	d. bent the float are as necessary to obtain the correct float height	[ ]	[ ]	[ ]	[ ]

LAP TM–23

Student _____

Date _____

SERVICING A CARBURETOR

Instructor's Final Checklist

Check the student's performance in the following elements of servicing a carburetor.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

		Student Performance			
		Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
3.	When installing a carburetor kit, the student:				
a.	turned off the fuel	[ ]	[ ]	[ ]	[ ]
b.	removed the carburetor	[ ]	[ ]	[ ]	[ ]
c.	separated the top and bottom of the carburetor	[ ]	[ ]	[ ]	[ ]
d.	removed the float, needle, seat, and gasket	[ ]	[ ]	[ ]	[ ]
e.	placed both halves of the carburetor body in cleaning solution for an adequate amount of time	[ ]	[ ]	[ ]	[ ]
f.	washed cleaning solution from the carburetor with very hot water	[ ]	[ ]	[ ]	[ ]
g.	blew all areas of the carburetor clean and dry with compressed air	[ ]	[ ]	[ ]	[ ]
h.	installed all new parts from kit	[ ]	[ ]	[ ]	[ ]
i.	checked and adjusted float height	[ ]	[ ]	[ ]	[ ]
j.	assembled the carburetor	[ ]	[ ]	[ ]	[ ]
k.	installed the carburetor on the engine	[ ]	[ ]	[ ]	[ ]
l.	made idle adjustments with the engine at operating temperature	[ ]	[ ]	[ ]	[ ]
m.	made load mixture adjustment with a dynamometer	[ ]	[ ]	[ ]	[ ]

LAP TM–23

Student _____

Date _____

SERVICING A CARBURETOR

(Continued)
Instructor's Final Checklist

Check the student's performance in the following elements of servicing a carburetor.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
n. completed installation in less than 1 1/2 hours	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

SERVICING THE INTAKE MANIFOLD

1. What is the purpose of the intake manifold?

Compare your answers with the correct responses on this page. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSE

1. The intake manifold carries the fuel-air mixture from the carburetor to the engine.

LAP TM-24

Student _____

Date _____

SERVICING THE INTAKE MANIFOLD

Instructor's Final Checklist

Check the student's performance in the following elements of servicing the intake manifold.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
In servicing the intake manifold, the student:				
1. Turned the fuel off first	[ ]	[ ]	[ ]	[ ]
2. Removed carburetor	[ ]	[ ]	[ ]	[ ]
3. Removed exhaust and intake manifolds	[ ]	[ ]	[ ]	[ ]
4. Cleaned all old gasket material from mating surfaces without scratching the surfaces	[ ]	[ ]	[ ]	[ ]
5. Cleaned manifold	[ ]	[ ]	[ ]	[ ]
6. Checked for warpage	[ ]	[ ]	[ ]	[ ]
7. Reinstalled manifolds with new gaskets	[ ]	[ ]	[ ]	[ ]
8. Reinstalled carburetor with new gasket	[ ]	[ ]	[ ]	[ ]
9. Torqued all nuts to specifications	[ ]	[ ]	[ ]	[ ]
10. There were no fuel leaks, and the engine started.	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

SERVICING THE GOVERNOR

Answer the following:

1. **What are two purposes of the governor on a tractor?**
   a.
   b.

2. **What is a common cause of governor "hunting"?**

3. **What type of governor is generally used on farm tractors?**

Compare your answers with correct responses in the answer below. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSES

1. a. Maintain a selected speed
   b. Limit the slow and fast speeds
2. Incorrect carburetor adjustment
3. Centrifugal

LAP TM–25

Student _____

Date _____

SERVICING THE GOVERNOR

Instructor's Final Checklist

Check the student's performance in the following elements of servicing the governor.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

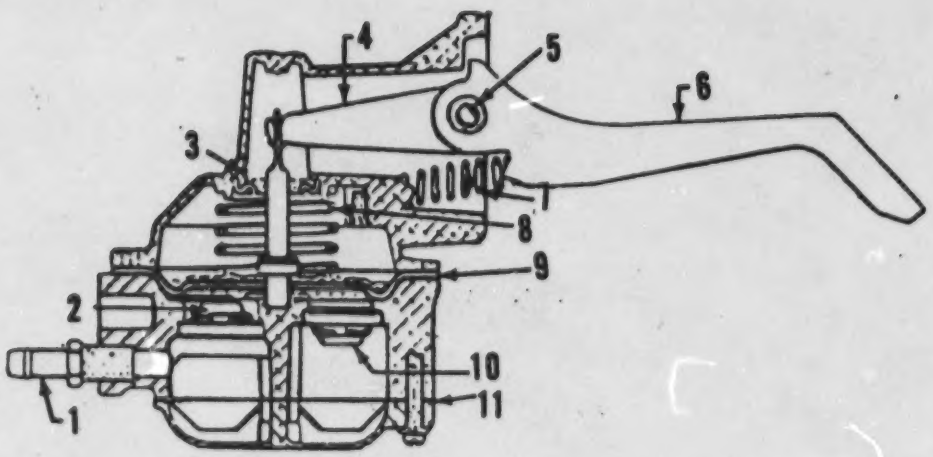
Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
In servicing the centrifugal governor, the student:				
1. tested the governor function at idle and under load	[ ]	[ ]	[ ]	[ ]
2. removed and disassembled the governor	[ ]	[ ]	[ ]	[ ]
3. replaced all worn parts and installed new gaskets	[ ]	[ ]	[ ]	[ ]
4. reassembled and installed governor	[ ]	[ ]	[ ]	[ ]
5. made necessary adjustments	[ ]	[ ]	[ ]	[ ]
6. tested for proper function	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

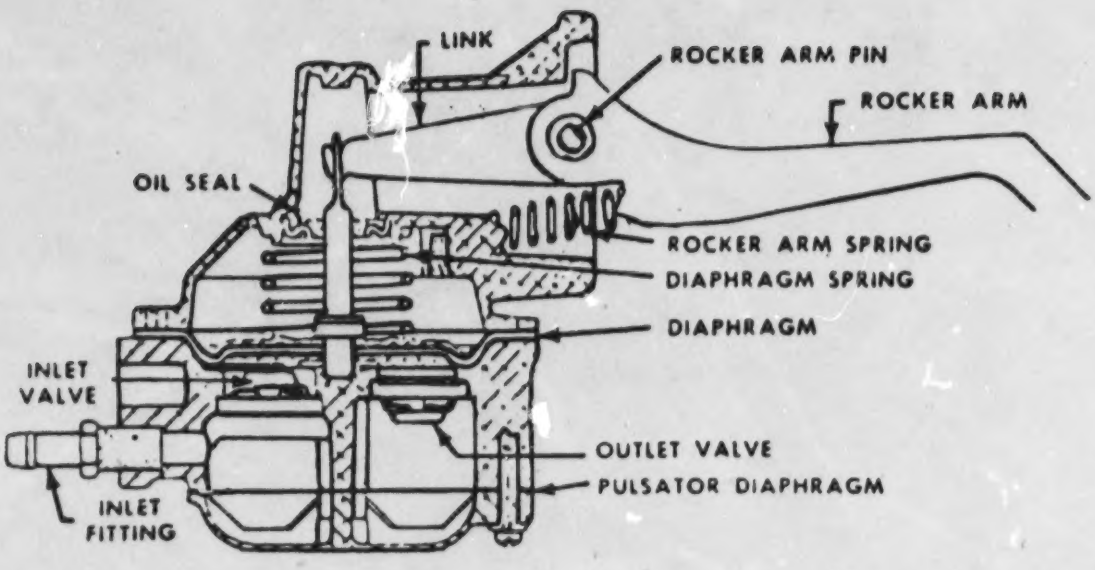
IDENTIFYING THE PARTS OF A FUEL PUMP

Label the parts of a fuel pump on the following diagram:



CORRECT RESPONSES

IDENTIFYING THE PARTS OF A FUEL PUMP



LAP TM–26

Student _____

Date _____

SERVICING THE FUEL PUMP

Instructor's Final Checklist

Check the student's performance in the following elements of servicing the fuel pump.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
1. In servicing the fuel pump, the student:				
a. checked the pump for defects	[ ]	[ ]	[ ]	[ ]
b. turned off the fuel	[ ]	[ ]	[ ]	[ ]
c. removed the pump from the engine	[ ]	[ ]	[ ]	[ ]
d. dismantled the pump	[ ]	[ ]	[ ]	[ ]
e. replaced the needed parts	[ ]	[ ]	[ ]	[ ]
f. reassembled the pump	[ ]	[ ]	[ ]	[ ]
g. reinstalled the pump	[ ]	[ ]	[ ]	[ ]
h. changed the oil (if necessary)	[ ]	[ ]	[ ]	[ ]
i. started the engine and checked for leaks	[ ]	[ ]	[ ]	[ ]
j. completed the task within five minutes of the time set by the instructor	[ ]	[ ]	[ ]	[ ]
2. In replacing the fuel pump, the student:				
a. turned off the fuel	[ ]	[ ]	[ ]	[ ]
b. removed the pump	[ ]	[ ]	[ ]	[ ]
c. cleaned the area	[ ]	[ ]	[ ]	[ ]

LAP TM–26

Student _____

Date _____

SERVICING THE FUEL PUMP
(Continued)
Instructor's Final Checklist

Check the student's performance in the following elements of servicing the fuel pump.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

		Student Performance			
		Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
d.	installed gaskets and pump	[ ]	[ ]	[ ]	[ ]
e.	torqued bolts to specifications	[ ]	[ ]	[ ]	[ ]
f.	reconnected fuel lines	[ ]	[ ]	[ ]	[ ]
g.	checked for leaks	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

UNDERSTANDING DIESEL FUEL FILTERS

Write a short answer for the following:

1. Why is it more important to keep a diesel engine fuel system clean than to keep a gasoline engine fuel system clean?

2. Two contaminants which are especially harmful in a diesel fuel injector are _____ and _____.

3. How does the operator know when to service a diesel fuel system?

4. Which stage filter must be changed most frequently?

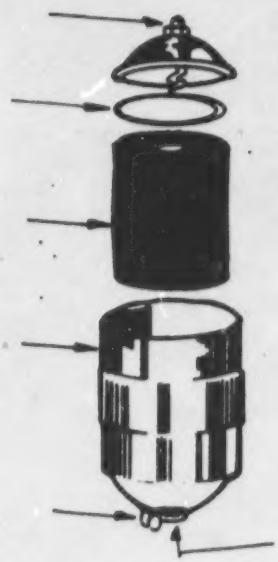
5. According to the John Deere publication *Fundamentals of Machine Operation: Preventive Maintenance*, filters should normally be changed every _____ hours. The second stage filter should be changed every _____ hours.

6. Identify each of the following types of filters.

Compare your answers with the correct responses on the following page. Review any incorrect answers before going on to the next Learning Activity.

A. _____

B. _____



C. _____

CORRECT RESPONSES

1. Because the very small openings in the injector nozzles are easily stopped up.

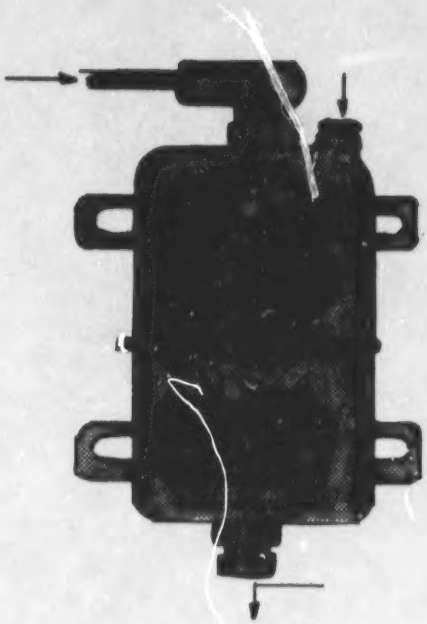
2. Water, dirt

3. By checking the manufacturer's service manual

4. First stage

5. 500,1000

6. (a) edge-type
   (b) yarn-type
   (c) paper element in a perforated can
   (d) paper filter in its own casing
   (e) sealed paper filter



E._____

D._____

LAP TM–27

Student _____

Date _____

SERVICING THE DIESEL FUEL FILTERS

Instructor's Final Checklist

Check the student's performance in the following elements of servicing the diesel fuel filters.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

		Student Performance			
		Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
1.	In servicing the diesel fuel filter system, the student:				
	a. checked the manufacturer's service manual for the correct procedure	[ ]	[ ]	[ ]	[ ]
	b. shut off the fuel	[ ]	[ ]	[ ]	[ ]
	c. removed the primary filters	[ ]	[ ]	[ ]	[ ]
	d. cleaned the container	[ ]	[ ]	[ ]	[ ]
	e. installed a new gasket	[ ]	[ ]	[ ]	[ ]
	f. installed a new filter	[ ]	[ ]	[ ]	[ ]
	g. tightened the bolt to the filter	[ ]	[ ]	[ ]	[ ]
	h. serviced the secondary filter	[ ]	[ ]	[ ]	[ ]
	i. bled the system	[ ]	[ ]	[ ]	[ ]
2.	After servicing the fuel filter system, the student:				
	a. started the engine	[ ]	[ ]	[ ]	[ ]
	b. checked the filter for leaks	[ ]	[ ]	[ ]	[ ]
	c. wiped off the excess fuel to prevent dust accumulation	[ ]	[ ]	[ ]	[ ]

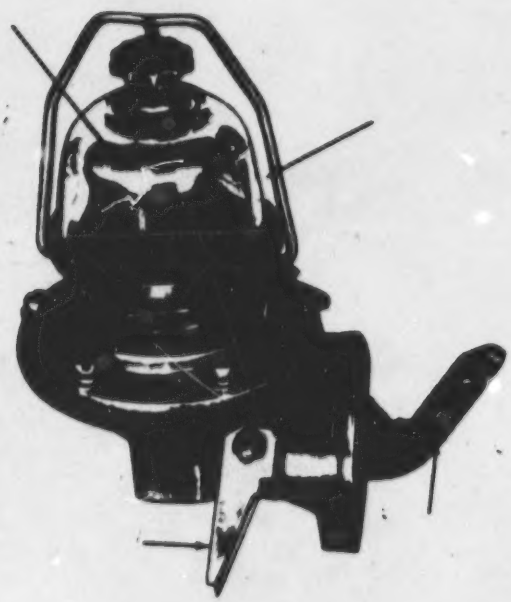
STUDENT SELF-CHECK

SERVICING A DIESEL TRANSFER PUMP

1. Briefly explain the function of the diesel transfer pump.

2. List the parts of a diesel fuel transfer pump. (see figure below)

Compare your answers with the correct responses at the bottom of this page. Review any incorrect answers before going on to the next Learning Activity.



CORRECT RESPONSES

1. The transfer pump supplies fuel to the injection pump.

2. See figure below.

LAP TM–28

Student _____

Date _____

SERVICING A DIESEL TRANSFER PUMP
Instructor's Final Checklist

Check the student's performance in the following elements of servicing a diesel transfer pump.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
1. In servicing the diesel transfer pump, the student:				
a. cleaned the pump and work area	[ ]	[ ]	[ ]	[ ]
b. removed the transfer pump without damage	[ ]	[ ]	[ ]	[ ]
c. washed the transfer pump in clean fuel oil	[ ]	[ ]	[ ]	[ ]
d. measured and replaced defective blades	[ ]	[ ]	[ ]	[ ]
e. reassembled the transfer pump to specifications	[ ]	[ ]	[ ]	[ ]
f. bled the system	[ ]	[ ]	[ ]	[ ]
g. checked the fuel pump pressure	[ ]	[ ]	[ ]	[ ]
h. completed the job within one hour	[ ]	[ ]	[ ]	[ ]
2. After being serviced by the student, the transfer pump:				
a. held a pressure reading which agreed with the specifications in the manufacturer's service manual	[ ]	[ ]	[ ]	[ ]
b. had no leaks	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

UNDERSTANDING DIESEL INJECTION PUMPS

Answer the following:

1. If the injection pump is made up of injector nozzle and pump, there is no high pressure line. (T or F)

2. What are the functions of the injector system?

3. Pressures of up to 5000 PSI (345 bars) can be reached by some fuel injection pumps. (T or F)

4. The three main types of injection systems are:

5. The four major ways of injecting fuel are:

Compare your answers with the correct responses at the bottom of this page. Review any incorrect answers before going on to the next learning Activity.

CORRECT RESPONSES

1. False

2. (a) Supply the correct amount of fuel
   (b) Time fuel delivery
   (c) Control rate of delivery
   (d) Atomize fuel
   (e) Distribute fuel in combustion chamber

3. True

4. (c) Common rail
   (b) Accumulator
   (c) Jerk pump

5. (c) Individual pump and nozzle
   (a) Combined pump and nozzle
   (c) Pumps in common housing, nozzles for each cylinder
   (d) One pump serving nozzles for several cylinders

LAP TM–29

Student _____

Date _____

SERVICING A DIESEL INJECTION PUMP

Instructor's Final Checklist

Check the student's performance in the following elements of servicing a diesel injection pump.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
1. In servicing the diesel injection pump, the student:				
a. checked the manufacturer's specifications of the engine for high idle, low idle, and basic engine timing	[ ]	[ ]	[ ]	[ ]
b. rotated the engine until the correct degree of timing came up at the flywheel	[ ]	[ ]	[ ]	[ ]
c. removed the plug at the pump or on the plate of the pump to see if the timing marks were in line	[ ]	[ ]	[ ]	[ ]
d. loosened the retaining bolts and rotated the pump clockwise or counterclockwise until the marks were exactly in line	[ ]	[ ]	[ ]	[ ]
e. retightened the bolts and started the engine	[ ]	[ ]	[ ]	[ ]
f. checked timing and advance	[ ]	[ ]	[ ]	[ ]
g. took a reading of the engine RPM at low idle and compared with the specifications	[ ]	[ ]	[ ]	[ ]
h. rotated the low-idle stop of the governor control until the correct low idle was reached	[ ]	[ ]	[ ]	[ ]
i. locked the low-idle screw down and installed a sealing wire to prevent movement	[ ]	[ ]	[ ]	[ ]
j. moved the fuel control lever to high idle and compared the tachometer reading with the manufacturer's specifications	[ ]	[ ]	[ ]	[ ]

LAP TM–29

Student _____

Date _____

SERVICING A DIESEL INJECTION PUMP
(Continued)
Instructor's Final Checklist

Check the student's performance in the following elements of servicing a diesel injection pump.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
k. moved the high-idle adjusting screw until the manufacturer's recommended setting was reached	[ ]	[ ]	[ ]	[ ]
l. locked down high-idle adjusting screw with a jam nut and installed a locking wire to prevent movement	[ ]	[ ]	[ ]	[ ]
m. operated the engine at high idle and checked for loose fittings and leaky lines	[ ]	[ ]	[ ]	[ ]
2. After being serviced by the student, the injector pump:				
a. supplied the correct quantity of fuel to the engine for smooth operation	[ ]	[ ]	[ ]	[ ]
b. delivered the fuel to the engine at the correct time	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

UNDERSTANDING DIESEL INJECTORS

Answer the following:

1. **What are the three functions of the injection nozzle?**

2. **Match the choices on the right with the two types of nozzles listed on the left.**

Type of Injector	Choices
	Pintle
(a) Inward opening	Hole
(b) Outward opening	Differential pressure
	Multiple orifice
	Pintaux
	Poppet

3. **List the three things we use nozzles for:**

4. **What kind of brush should you use to clean the nozzles?**

5. **Injection nozzles use _____ pressure to oppose _____ pressure.**

6. **It is correct to mix nozzle parts if they are of the exact same type. (T or F)**

Compare your answers with the correct responses at the bottom of this page. Review any questions you answered incorrectly before going on to the next Learning Activity.

CORRECT RESPONSES

1. (a) Atomize the fuel
   (b) Spread the fuel spray to fully mix it with air
   (c) Inject fuel equally in all cylinders
2. (a) Differential, Hole, Pintle, Pintaux
   (b) Poppet, Pintle, Multi-orifice
3. (a) Chatter and spray pattern
   (b) Opening pressure
   (c) Valve leakage
4. Brass
5. (a) Spring (b) Fuel
6. False

LAP TM–30

Student _____

Date _____

SERVICING A DIESEL FUEL INJECTOR

Instructor's Final Checklist

Check the student's performance in the following elements of servicing a diesel fuel injector.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
In servicing the fuel injector, the student:				
1. cleaned the injector body in diesel fuel after removal from the engine	[ ]	[ ]	[ ]	[ ]
2. removed the carbon from the tip with a brass wire brush	[ ]	[ ]	[ ]	[ ]
3. disassembled nozzles without damaging parts	[ ]	[ ]	[ ]	[ ]
4. kept nozzle bodies and valves matched for the individual injector	[ ]	[ ]	[ ]	[ ]
5. cleaned the slip opening, seat, and sac hole	[ ]	[ ]	[ ]	[ ]
6. polished the guide to the body	[ ]	[ ]	[ ]	[ ]
7. cleaned out the lapping compound completely and reassembled the nozzle	[ ]	[ ]	[ ]	[ ]
8. set opening pressure, pattern, and leak off according to the manufacturer's specifications	[ ]	[ ]	[ ]	[ ]
9. adjusted the spray patterns, opening pressure, and nozzle lift	[ ]	[ ]	[ ]	[ ]
10. torqued the lock nut	[ ]	[ ]	[ ]	[ ]
11. checked for seat leakage at 1500 PSI and 2400 PSI	[ ]	[ ]	[ ]	[ ]

LAP TM–30

Student _____

Date _____

SERVICING A DIESEL FUEL INJECTOR

(Continued)
Instructor's Final Checklist

Check the student's performance in the following elements of servicing a diesel fuel injector.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
12. installed new carbon dam seal and top seals	[ ]	[ ]	[ ]	[ ]
13. reinstalled the nozzle into the system	[ ]	[ ]	[ ]	[ ]
14. bled the system	[ ]	[ ]	[ ]	[ ]
15. checked operation of the engine	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

BLEEDING A DIESEL FUEL SYSTEM

Complete the following:

1. **Why is it necessary to bleed a diesel engine?**

2. **In the space below, diagram the fuel system for the designated tractor. Show all parts and lines. Number each part in the sequence which you would use to bleed the system.**

Compare your answers with the correct responses at the bottom of this page. Review any incorrect answers before going on to the next Learning Activity

CORRECT RESPONSES

1. To remove trapped air which would cause the engine to run rough or fail to start.
2. Check the references in Learning Activities 1–3.

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Student _____

Date _____

BLEEDING THE DIESEL FUEL SYSTEM

Instructor's Final Checklist

Check the student's performance in the following elements of bleeding the diesel fuel system.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
1. In bleeding the diesel fuel system, the student:				
a. checked the manufacturer's service manual for the recommended bleeding order	[ ]	[ ]	[ ]	[ ]
b. checked fuel tank for ample fuel	[ ]	[ ]	[ ]	[ ]
c. turned on the fuel cut-off at the tank	[ ]	[ ]	[ ]	[ ]
d. loosened the bleed plugs at the primary fuel filter	[ ]	[ ]	[ ]	[ ]
e. activated the manual fuel pump lever on the priming pump until clean fuel flowed from the filter	[ ]	[ ]	[ ]	[ ]
f. closed the primary bleed plug	[ ]	[ ]	[ ]	[ ]
g. opened the secondary fuel filter bleed plug	[ ]	[ ]	[ ]	[ ]
h. activated the manual fuel pump lever on the priming pump until clean fuel came from the secondary filter.	[ ]	[ ]	[ ]	[ ]
i. closed the bleed plug	[ ]	[ ]	[ ]	[ ]
j. continued operating the fuel pump for 10–12 more strokes	[ ]	[ ]	[ ]	[ ]
k. took wrenches and loosened the injector high pressure lines at the nozzle	[ ]	[ ]	[ ]	[ ]

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Student _____

Date _____

BLEEDING THE DIESEL FUEL SYSTEM

(Continued)
Instructor's Final Checklist

Check the student's performance in the following elements of bleeding the diesel fuel system.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

		Student Performance			
		Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
l.	turned the engine over until fuel with no air came out at the connection	[ ]	[ ]	[ ]	[ ]
m.	tightened the lines	[ ]	[ ]	[ ]	[ ]
n.	repeated this procedure until all nozzle lines were bled	[ ]	[ ]	[ ]	[ ]
2.	After having the fuel lines bled:				
a.	the tractor started	[ ]	[ ]	[ ]	[ ]
b.	the engine ran smoothly	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

TIMING A FUEL INJECTION PUMP

1. If the fuel injection pump is not properly timed, the engine will _____ and _____.

2. If the timing marks are 1/4 inch (approximately 63 mm) apart, the engine is adequately tuned. (T or F)

CORRECT RESPONSES

1. Misfire, lose power

2. False

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Student _____

Date _____

TIMING A FUEL INJECTION PUMP

Instructor's Final Checklist

Check the student's performance in the following elements of timing a fuel injection pump.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
1. While timing a fuel injection pump, the student:				
a. checked the manufacturer's specifications	[ ]	[ ]	[ ]	[ ]
b. shut off the fuel supply valve	[ ]	[ ]	[ ]	[ ]
c. removed timing window cover	[ ]	[ ]	[ ]	[ ]
d. brought the piston up on the compression stroke with the No. 1 injector removed	[ ]	[ ]	[ ]	[ ]
e. rotated the engine to match the timing marks	[ ]	[ ]	[ ]	[ ]
2. If the timing marks did not match, the student:				
a. loosened the pump	[ ]	[ ]	[ ]	[ ]
b. turned the pump to match the marks	[ ]	[ ]	[ ]	[ ]
c. tightened the bolts	[ ]	[ ]	[ ]	[ ]
d. rechecked the timing after turning the engine over	[ ]	[ ]	[ ]	[ ]
3. The timed fuel injector pump:				
a. was timed within one-half of a degree of the specifications given in the manufacturer's service manual	[ ]	[ ]	[ ]	[ ]
b. caused the engine to run smoothly	[ ]	[ ]	[ ]	[ ]

STUDENT SELF-CHECK

SERVICING A TURBOCHARGER

Answer the following:

1. A turbocharger is a type of centrifugal supercharge. (T or F)

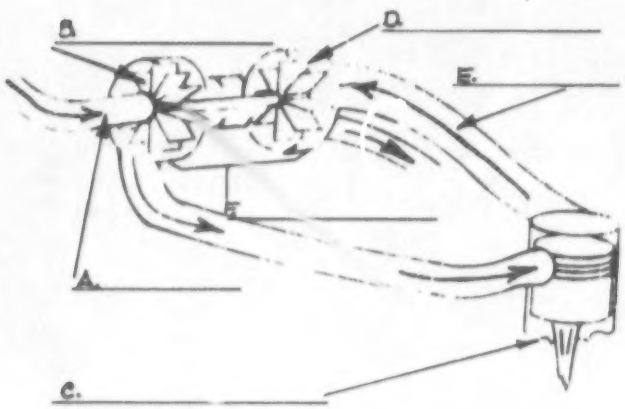
2. A turbocharger is an exhaust-driven turbine which drives a compression wheel. (T or F)

3. What is the major job of the turbocharger?

4. The _____ of the turbocharger is located between the air cleaner and the intake manifold, while the _____ is located between the exhaust manifold and the muffler.

5. The turbocharger is considered to be an effective spark arrester. (T or F)

6. Label the following sketch:



7. Name five advantages of using a turbocharger.

   a.
   b.
   c.
   d.
   e.

8. What special actions must be taken if an engine with a turbocharger in it stalls?

9. A whine heard during shut-down of a turbocharger indicates bearing failure. (T or F)

10. Which of the following is NOT a recommended point for periodic inspection?

    a. Turbocharger mountings and connections (for oil leakage)
    b. Engine crankcase (for restricted oil flow)
    c. Air cleaner (serviced if dirty)
    d. Turbocharger in operation (for vibration)
    e. Engine under load (for excess smoke)
    f. Engine at rated RPM (for unusual noise)
    g. Turbocharger bearings (grease zerks regularly)

Compare your answers with the correct responses on the next page. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSES

1. True
2. True
3. Force more air into the engine cylinder
4. Compressor, turbine
5. True
6. a. fresh air intake
   b. compressor
   c. cylinder
   d. turbocharger
   e. exhaust gases
   f. turbine
7. a. increase horsepower
   b. reduce weight
   c. reduce cost
   d. more power at high altitude
   e. reduce smoke
8. Restart immediately
9. False
10. g

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Student _____

Date _____

SERVICING A TURBOCHARGER

Instructor's Final Checklist

Check the student's performance in the following elements of servicing a turbocharger.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
1. In servicing the turbocharger, the student:				
a. cleaned area around turbocharger	[ ]	[ ]	[ ]	[ ]
b. removed the air intake lines from the turbocharger	[ ]	[ ]	[ ]	[ ]
c. removed the adapter, air lines, exhaust elbow and other loose connections	[ ]	[ ]	[ ]	[ ]
d. unbolted the turbocharger and removed it from the exhaust manifold	[ ]	[ ]	[ ]	[ ]
e. cleaned the manifold completely of the old gasket	[ ]	[ ]	[ ]	[ ]
f. inspected the blades of the turbocharger through the housing and end openings	[ ]	[ ]	[ ]	[ ]
g. checked the radial bearing play through the air outlet port while moving both ends of the turbine shaft equally	[ ]	[ ]	[ ]	[ ]
h. checked the shaft end-play with a dial indicator	[ ]	[ ]	[ ]	[ ]
i. compared the reading with the manufacturer's service manual	[ ]	[ ]	[ ]	[ ]
j. installed a new gasket when replacing the turbocharger to the exhaust manifold	[ ]	[ ]	[ ]	[ ]
k. torqued to the desired tightness	[ ]	[ ]	[ ]	[ ]
l. reinstalled the air lines, outlet lines, and adapter between the turbocharger and the exhaust elbow	[ ]	[ ]	[ ]	[ ]
m. checked all air lines for tightness	[ ]	[ ]	[ ]	[ ]

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Student _____

Date _____

SERVICING A TURBOCHARGER (cont'd.)

Instructor's Final Checklist

Check the student's performance in the following elements of servicing a turbocharger.

Place an X in the appropriate box indicating not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the "Not Applicable" box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will discuss this and decide which learning activities must be repeated.

		Student Performance			
		Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
n.	pulled the engine stop and turned the engine over until the oil pressure gauge showed a working range of oil pressure	[ ]	[ ]	[ ]	[ ]
2.	The turbocharger, after being serviced by the student:				
a.	rotated freely	[ ]	[ ]	[ ]	[ ]
b.	had at least 1/16" of free play	[ ]	[ ]	[ ]	[ ]
c.	had no noisy operation or vibration	[ ]	[ ]	[ ]	[ ]